

The C2 Workstation and Data Replication over Disadvantaged Tactical Communication Links

Presentation held at the NATO RTO-IST Taskgroup
12 Workshop on September 11th&12th in Quebec,
Canada

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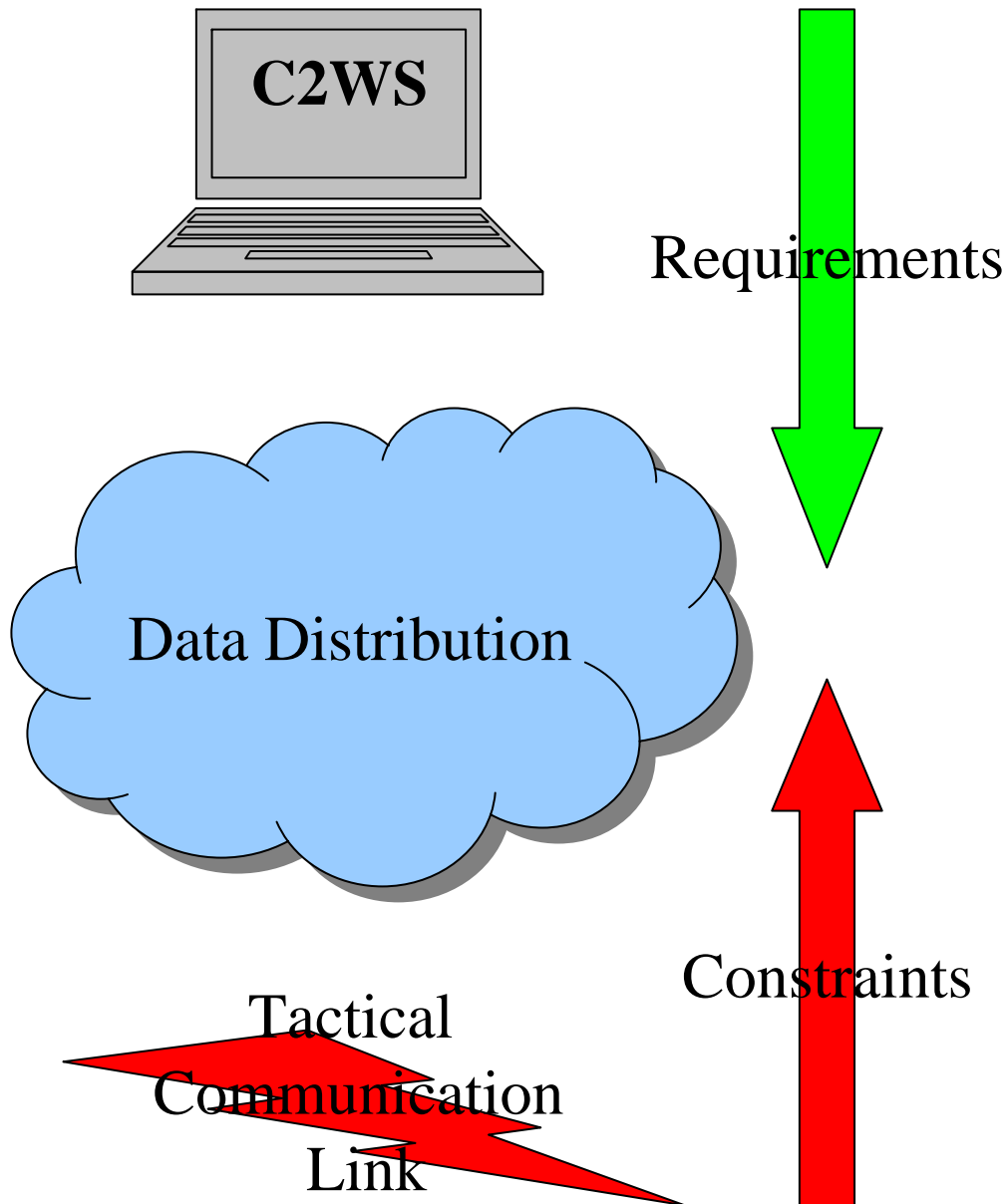
Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE 01 DEC 2007		2. REPORT TYPE N/A		3. DATES COVERED	
4. TITLE AND SUBTITLE The C2 Workstation and Data Replication over Disadvantaged Tactical Communication Links				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) TNO Physics and Electronics Laboratory				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 14	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Part 1. Introduction

Structure of this Presentation:

- Part 1. Introduction
- Part 2. The Problem Domain
- Part 3. The C2 Workstation (C2WS)
- Part 4. Conclusions and Recommendations

Part 2. The Problem Domain for this Presentation



How to:

- Collaborative working**
- Selective data distribution
- (Re-)Synchronisation
- Stand alone operation
- Security**

Despite:

- Limited bandwidth
- Limited reach
- Frequent disconnects
- Latency
- Out of order delivery
- Missing data packages
- Corrupt data packages
- Dynamic topology**

Part 3. The C2 Workstation (C2WS)

The screenshot displays the MDIForm1 C2 Workstation interface, which is a multi-paneled application. The main window is a web browser showing the weather.com website for Ambon, Indonesia. The browser's address bar shows the URL <http://www.weather.com/ambon.htm>. The website content includes a weather forecast and current conditions for Ambon, Indonesia, as reported on Monday, October 2, at 8:12 AM EDT. The forecast shows a 3-day outlook with temperatures ranging from 76°F to 84°F. The current conditions section indicates a 'No Report' for temperature, wind, dewpoint, and relative humidity.

On the left side of the interface is a vertical console with various icons and labels: GIS 2D, GIS 3D, Intranet, Supplies, MIS, Video Conference, CNN, Weather, Vuursteen, and Messages. The right side features an Alerts panel with a list of messages and their timestamps, and a COP Catalog panel showing a hierarchical list of operations and phases.

Alerts Panel:

Alert	Time
Alert messag...	11:17:5
Question mes...	11:17:4
Critical messa...	11:17:2
Alert messag...	11:17:1
Critical messa...	11:17:0
Question mes...	11:16:9
Critical messa...	11:16:4
Question mes...	11:16:3
Information m...	11:16:2
Critical messa...	11:16:1
Alert messag...	11:16:0
Information m...	11:15:9
Question mes...	11:15:4
Alert messag...	11:15:3
Critical messa...	11:15:2
Question mes...	11:15:1

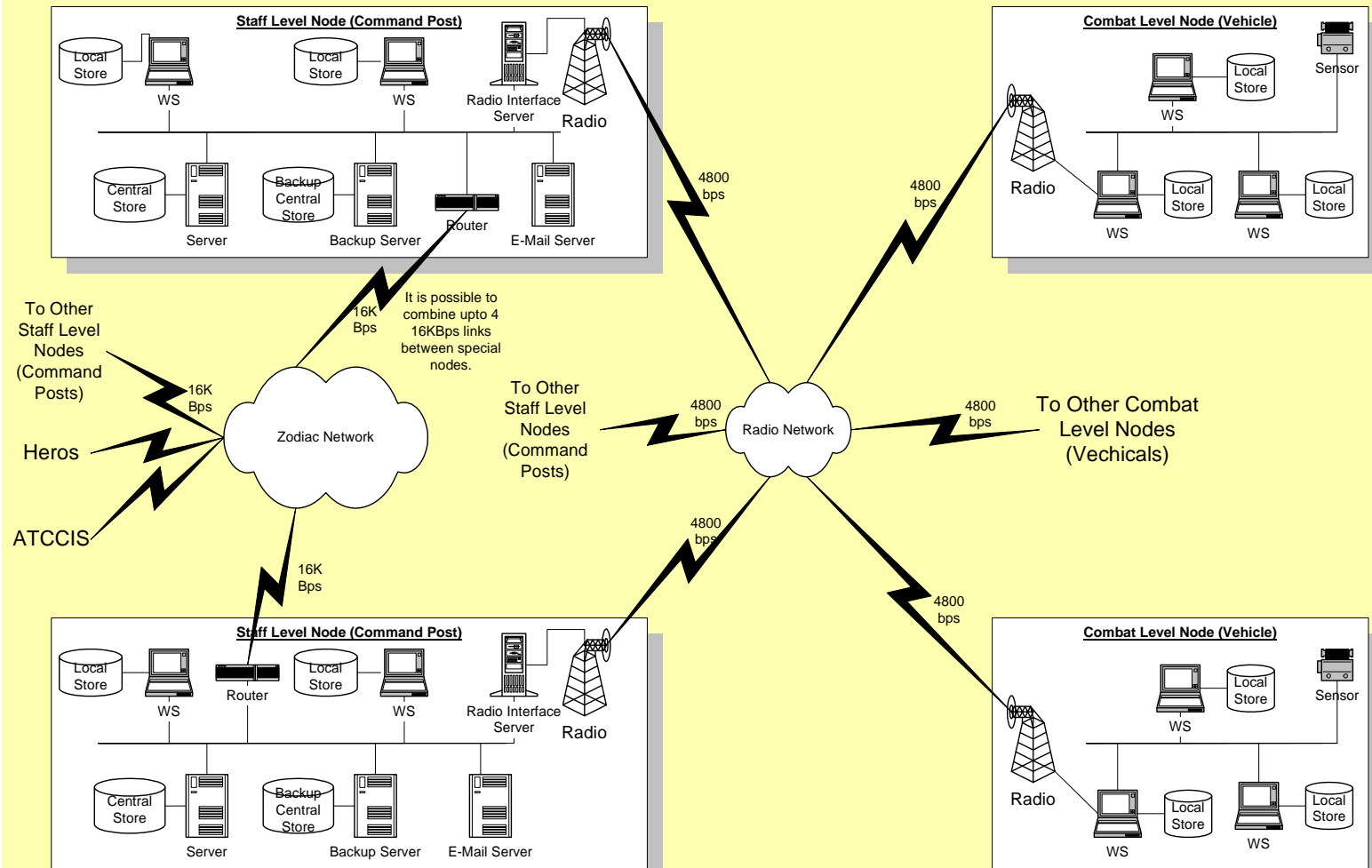
COP Catalog Panel:

- ☐ Operation Swamp
 - ☐ Phase 1
- ☐ Operation Adventure
 - ☒ 1 Div
 - ☐ 13 Bgd
- ☒ Operation Open Plan

The bottom of the interface shows a taskbar with icons for 2D GIS, AMMO/F..., and Browser.

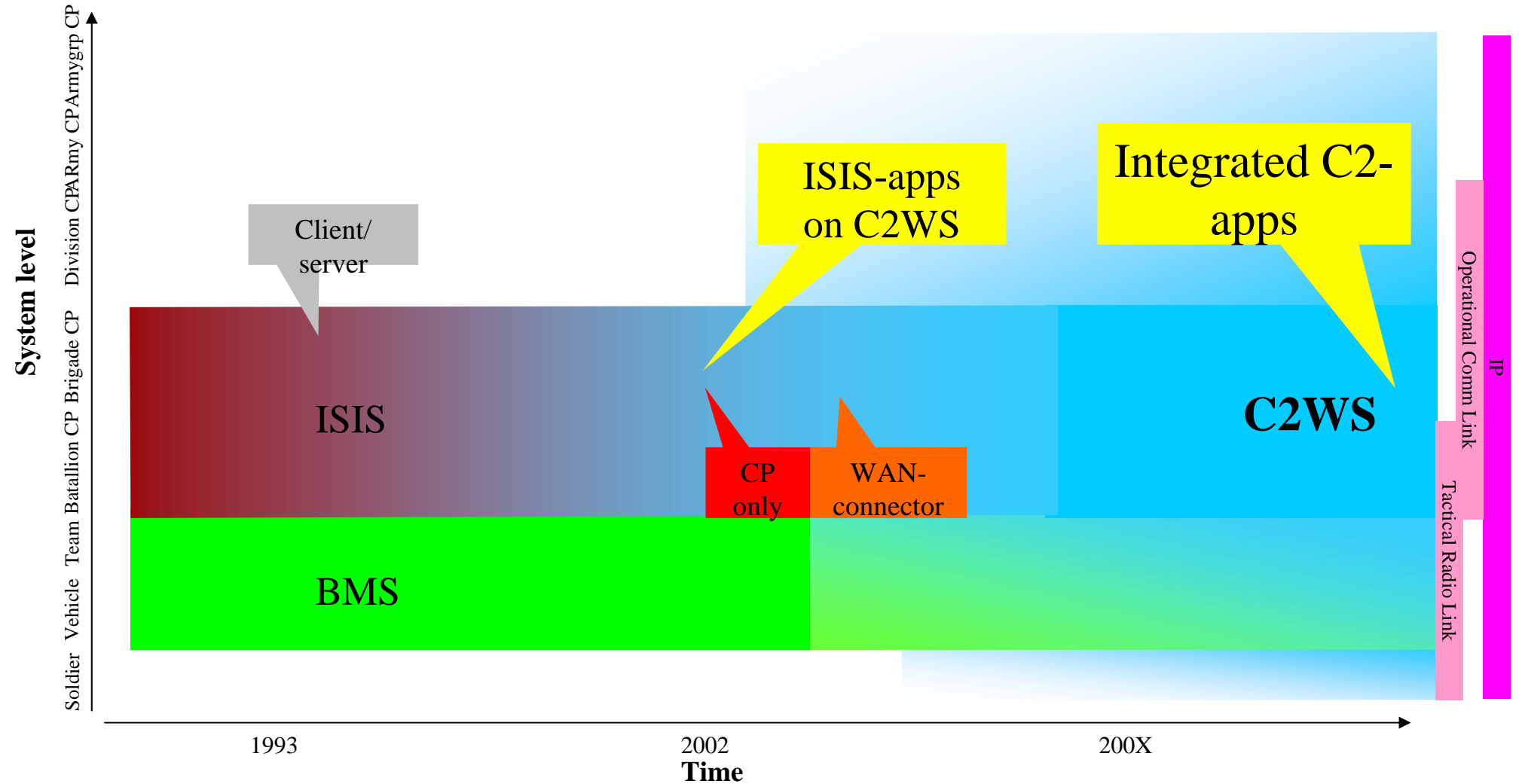
C2WS Physical Environment

C2WS System Architecture Context Diagram



C2WS Evolution

Basic Functionality - Stability - Performance – Data Distribution – Management – Security – Extend Functionality



C2WS Design Decisions I - Workstation

- Local data store (client **or** server!)
Each workstation is a replication node!
- Overlays to group information
- Publish/Subscribe on a per Overlay basis
 - no servers, no single point of failure
 - Catalog of available information
- Parallel synchronisation and processing of (out of order) messages

C2WS Design Decisions II - Data Distribution I

- Supports Overlay Concept
- Publish/Subscribe – COTS product
- C2WS messages
 - unit of data distribution
 - can be processed ‘out of order’
 - can be distributed with different QoS settings (future)
 - can be encrypted and signed (future)
 - portable data (XML) -> C2XML
 - ‘(delta) object completeness’

C2WS Design Decisions III - Data Distribution II

- Synchronization
 - For subscribed Overlays:
 - Active Information and/or
 - Historic Information (time period)
 - Configurable data loggers/synchronization servers
 - Heartbeat
- Multi-master replication with loose consistency & convergence

Collaborative work on a shared Overlay

- Last update wins
 - Version numbers on object-attribute values
 - Conflict resolution on a per attribute basis only.
- Data conflict
 - Normal (foreign key, transactional) integrity is not enforced in favor of availability.
 - Left to end users after synchronizing
 - Replication mechanism only provides convergence
- Differing view - different overlay
 - Within an Overlay, data will most likely be contributory than conflicting

C2WS versus ATCCIS/MIP DEM

ATCCIS	C2WS
Database replication	Info bus
Contracting	Publish/subscribe per overlay
Contracts (predefined)	Overlays (flexible)
Relational	Object oriented
Proprietary PDU syntax	XML
Fixed QoS	COTS MOM
LC2IEDM	C3I info model
Ownership	<u>Update anywhere; access control lists/ last wins</u>
Database table changes	Object(change)s
Full bulk synchronization	Synchronization options
Increments after full bulk	Concurrent synchronization & regular data exchange

Part 4. Conclusions & Recommendations

- C2WS principles
 - Data organized in Overlays
 - Update anywhere, collaborative work
 - Use Publish-Subscribe paradigm
- Challenges:
 - Proof of the pudding...
 - How to use Overlays?
 - vehicle level and down?
 - Combine security & publish-subscribe?

Conclusions & Recommendations

- Recommendations
 - Contact TNO and/or C2 Support Centre
 - Join MIP/Seawg
 - Take care

Questions?